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**Bibliography.**

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**Summary.**

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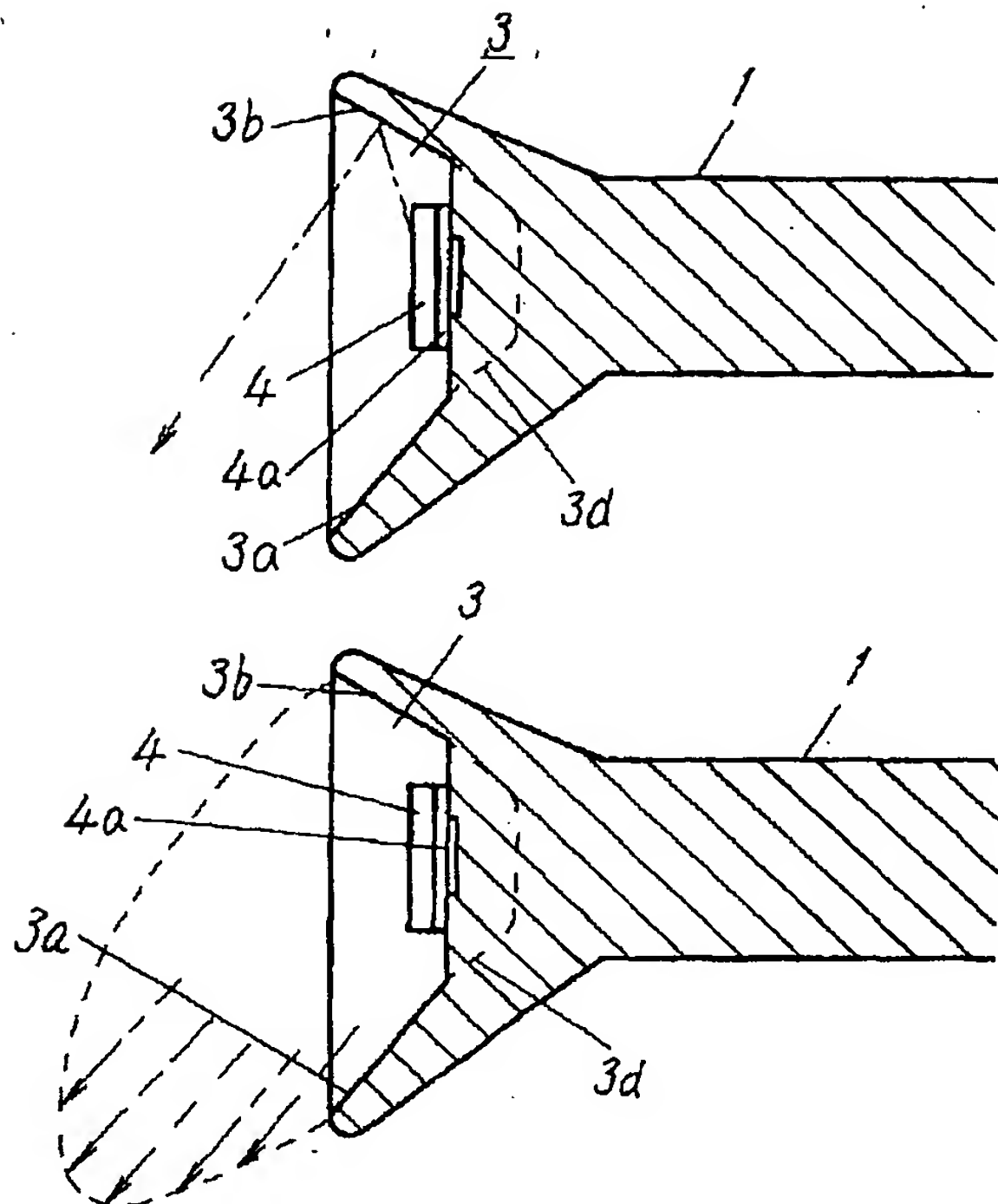
(57) [Abstract]

[Technical problem] The luminescence equipment with which a luminescence display panel good [ without being influenced of a manufacture error, as the luminous-intensity-distribution nature from a light emitting device can always be set up uniformly ] is obtained is offered.

[Means for Solution] While having the light emitting device 4 which carried out the laminating of the semiconductor layer of p-n junction, and the leadframe 1 which makes a light emitting device flow through the mounting 3 in which this light emitting device 4 is carried electrically in preparation for one on crystal substrate 4a and using mounting 3 as the concave object of the depth which is the grade in which the main light drawing side where luminescence brightness is the highest is buried among the optical drawing side in a light emitting device 4. It has the reflector structure which can give the reflected light of a light emitting device 4 which gives directivity to the light from the whole surface at least, and if it is the case of the light from the main light drawing side, or transparent crystal substrate 4a, the luminous intensity distribution of the light which gave directivity from the reflector of mounting 3 also including the light by the side of the side and the back will be made possible.

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**CLAIMS**

[Claim(s)]

[Claim 1] Semiconductor luminescence equipment which comes to have the reflector structure characterized by providing the following of reflecting discharge light other than the direction of the main optical axis of a light emitting device in the direction with the degree of incidence crossed axes angle of the fixed range to a flat surface. The light emitting device which carried out the laminating of the semiconductor layer of p-n junction on the crystal substrate. It is semiconductor luminescence equipment which was equipped with the loading flow member through which carries this light emitting device and it is made to flow electrically, and formed mounting which made the inside the light reflex side while considering as the concave object of the depth which is the grade by which the optical drawing side of a light emitting device is buried in a loading flow member, and is the main optical axis from the main light drawing side of a light emitting device where luminescence brightness is the

highest in mounting.

[Claim 2] The reflector structure of mounting contains the main reflector and the subreflector which were classified into two fields which counter on both sides of a light emitting device in between. The degree of crossed axes angle of the main reflector and a subreflector, and the main optical axis of each light emitting device is relatively considered as smallness and an adult relation. Semiconductor luminescence equipment according to claim 1 to which the quantity of light distribution of the reflected light of the discharge light from other than the diffused light from the main light drawing side and this main light drawing side makes it come so that a subreflector side may become large rather than the main reflector side to incline.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[The technical field to which invention belongs] this invention relates to the luminescence equipment which the luminous-intensity-distribution nature from luminescence equipment is raised, and enabled it to optimize the luminescence display by making proper the angle of the reflector which starts the luminescence equipment which carries a Light Emitting Diode light emitting device in mounting formed in the cast of a leadframe, a printed circuit board, or others, especially is formed in mounting.

[0002]

[Description of the Prior Art] The Light Emitting Diode light emitting device which formed the semiconductor cascade screen which carried out the laminating of the semiconductor thin film layer to the crystal substrate, and carried out p-n junction to it, and was equipped with the electrode by the side of p and n from the former is used abundantly as an object for luminescence display panels. The thing of this Light Emitting Diode light emitting device being carried after mounting beforehand formed in the leadframe which it has as a member for for example making it flowing electrically, and connecting with a leadframe by wirebonding is the fundamental composition.

[0003] Drawing 5 is the schematic diagram showing the conventional example of the loading structure of the light emitting device to mounting of such a leadframe.

[0004] The example of illustration is what can be used as a blue Light Emitting Diode which carried out the laminating of the semiconductor film of a gallium-nitride system compound. Carry a light emitting device 51 on mounting 52a which formed the insulating substrate 51a in the upper limit of a leadframe 52, and it is pasted up with a paste 53. 51c is connected very much to the leadframe 55 of another side which is making a leadframe 52 and this, and the pair with Wires 54a and 54b the 51b

and n side the p side formed in the upper limit of a light emitting device 51, respectively. And the whole circumference of mounting 52a including a light emitting device 51 is closed by the epoxy resin 56.

[0005] With the Light Emitting Diode lamp containing such a light emitting device 51, upward luminescence is obtained considering the upper surface of p type layer which occupies the field which contains 51b very much the p side as an optical drawing side by making the p-n junction region of the semiconductor film of the gallium-nitride system compound of a light emitting device 51 into a luminous layer. Moreover, in what used substrate 51a as transparent sapphire, it is reflected from this mounting 52a, and the light which goes to mounting 52a from a luminous layer joins luminescence from an optical drawing side also including a part for this reflection.

[0006] Each Light Emitting Diode lamp serves as a pixel, respectively, and a display and color display of various kinds of pictures are possible for the luminescence display panel which many Light Emitting Diode lamps [ equipped with the light emitting device 51 ] in three primary colors were gathered, and has arranged them on the other hand. And this luminescence display panel has a thing for the large-sized screens of an outdoor type from a comparatively small thing, and the installation is also various.

[0007] For example, operators, such as a pedestrian on a foot walk and an automobile under run, have [ offer of the information according to a display by the case where a luminescence display panel is prepared in the high position in alignment with the facing wall of a building ] an object and a common bird clapper. Therefore, it becomes the relation from which an optical path will shift greatly to an observer if it arranges to a display panel, rotating [ in / drawing / by the case of the Light Emitting Diode luminescence equipment which there were many postures looked up at when a pedestrian and an operator look at a display panel and bird clappers, and was shown in drawing 5 ] this 90 degrees clockwise, and using the optical axis as horizontal.

[0008] Then, as shown in drawing 6 , the luminous-intensity-distribution nature of light can be given to those who look up at slanting facing down, then a luminescence display panel for a setup of the optical path by mounting 52a for a light emitting device 51 and a light reflex. Thereby, for those who look at a display, a display will be a bright and more skillful thing.

[0009]

[Problem(s) to be Solved by the Invention] In order to make the optical axis of the light from a light emitting device 51 into facing down, for example, as shown in (a) of drawing 6 , it can respond by bending downward the leadframes 52 and 55 linked to the printed circuit board 57 which it has all over a luminescence display panel. Moreover, since the error of the posture by the bending deformation of leadframes 52 and 55 is suppressed, as shown in (b) of this drawing, a part of printed circuit board 57 can be aslant pushed down on tongue-shaped, and the sense of a light emitting device 51 can also be doubled with a ground side.

[0010] However, in the case where bending of leadframes 52 and 55 or the printed circuit board 57 is carried out, since each angle of bend is accompanied by the manufacture error, producing dispersion is not avoided but it must also make management in manufacture process severe. And if the precision of angle of bend becomes poor, dispersion will be caused also in the direction of luminous intensity distribution of the light emitting device 51 corresponding to each pixel, and the clearness of the image display from a luminescence display panel will also be affected greatly.

[0011] Thus, conventionally, a manufacture error cannot be disregarded but it is easy to become complicated with structure, although the form of a luminescence display is maintainable good, if a light emitting device 51 is incorporable into a luminescence display panel with a proper posture so that it may point to an observer side also in respect of quality control.

[0012] The technical problem which should be solved in this invention is to offer the luminescence



equipment with which a luminescence display panel good [ without being influenced of a manufacture error, as the luminous-intensity-distribution nature from a light emitting device can always be set up uniformly ] is obtained.

[0013]

[Means for Solving the Problem] this invention is equipped with the loading flow member through which carries the light emitting device which carried out the laminating of the semiconductor layer of p-n junction, and this light emitting device on a crystal substrate, and it is made to flow electrically. to a loading flow member It is the semiconductor luminescence equipment in which mounting which made the inside the light reflex side while considering as the concave object of the depth which is the grade in which the optical drawing side of a light emitting device is buried was formed. for mounting It has the reflector structure of reflecting discharge light other than the direction of the main optical axis of a light emitting device in the direction with the degree of incidence crossed axes angle of the fixed range, to the flat surface containing the main optical axis from the main light drawing side of a light emitting device where luminescence brightness is the highest, and is characterized by the bird clapper.

[0014] When a light emitting device is carried in mounting being formed at the nose of cam of this leadframe, the light from other optical drawing sides can also give directivity, and can make it emit light in the optical drawing side of a light emitting device by the case where a leadframe is used, for example as a loading flow member, not to mention the light from the main light drawing side where luminescence brightness is the highest with such composition. In this case, in what was made into the posture which the main light drawing side is the light emitting device of the transparent crystal substrate which was in agreement in the luminescence direction, and stood face to face against the loading side of mounting of a crystal substrate, the light which leaks from this transparent crystal substrate is recoverable as the reflected light from mounting.

[0015] In addition, in this invention, the loading flow member through which carries a light emitting device and it is made to flow electrically is a leadframe as the term of the gestalt of implementation of invention shows, in addition let them be various kinds of casts arranged as another object above a printed circuit board and a printed circuit board.

[0016]

[Embodiments of the Invention] Invention according to claim 1 is equipped with the loading flow member through which carries the light emitting device which carried out the laminating of the semiconductor layer of p-n junction, and this light emitting device on a crystal substrate, and it is made to flow electrically. to a loading flow member It is the semiconductor luminescence equipment in which mounting which made the inside the light reflex side while considering as the concave object of the depth which is the grade in which the optical drawing side of a light emitting device is buried was formed. for mounting As opposed to the flat surface containing the main optical axis from the main light drawing side of a light emitting device where luminescence brightness is the highest It is the thing which comes to have the reflector structure of reflecting discharge light other than the direction of the main optical axis of a light emitting device in the direction with the degree of incidence crossed axes angle of the fixed range. by the mounting itself If it has the light and the transparent crystal substrate from the main light drawing side of a light emitting device, it has operation of taking out efficiently the light emitted from the side and rear face.

[0017] Invention according to claim 2 the reflector structure of mounting The main reflector and the subreflector which were classified into two fields which counter on both sides of a light emitting device in between are included. The degree of crossed axes angle of the main reflector and a subreflector, and the main optical axis of each light emitting device is relatively considered as

smallness and an adult relation. It has operation that the quantity of light distribution of the reflected light of the discharge light from other than the diffused light from the main light drawing side and this main light drawing side makes it come so that a subreflector side may become large rather than the main reflector side to incline, and can add the reflected light from the main reflector as a luminous-intensity-distribution component of the inclination place.

[0018] Below, the example of the gestalt of operation of this invention is explained, referring to a drawing. It is drawing of longitudinal section according [ accord / the plan of drawing 1 / drawing of longitudinal section of the important section of the Light Emitting Diode lamp equipped with the Light Emitting Diode chip by which drawing 1 is formed with the semiconductor film of the gallium-nitride system compound in the gestalt of 1 operation of this invention as a light emitting device, and drawing 2 / drawing 3 ] to the A-A line view of drawing 1 .

[0019] a loading flow [ in / the gestalt of this operation of one leadframe 1 / in drawing, it has the leadframes 1 and 2 of the couple by which the upper-limit section is closed by the epoxy resin, and ] -- it is considering as the member While being able to dent mostly the mounting 3 for carrying a light emitting device 4 in the upper limit of one leadframe 1 in the shape of a earthenware mortar and forming it, the whole inner skin is made into the shape of a mirror plane. A light emitting device 4 forms p lateral-electrode 4b and n lateral-electrode 4c in a upper-limit side while preparing crystal substrate 4a using transparent sapphire in a soffit side, and it is carrying out wirebonding of these each to leadframes 1 and 2 with Wires 5a and 5b.

[0020] A light emitting device 4 makes p type layer which is the upper surface and contains p lateral-electrode 4b the main light drawing side where luminescence brightness is the highest, and emits light towards the side and lower part also from crystal substrate 4a located at the luminous layer bottom including the main optical axis in the luminescence optical path from this main light drawing side.

[0021] As shown in drawing 2 , mounting 3 is formed in the shape of [ to which a flat-surface configuration carries out eccentricity of this, and arranges it to the square light emitting device 4 mostly / like ] a earthenware mortar, sets the eccentric direction of a light emitting device 4, and the sense by the side of reverse to subreflector 3a of about 40-degree inclination, and is setting this and the field which counters to main reflector 3b of about 60-degree inclination. and the 2nd which gives the directivity of the cross direction of the optical path which made the inclination about 50 degrees as shown in drawing 1 between such subreflector 3a and main reflector 3b -- secondary -- it is referred to as reflector 3a-1

[0022] Maintenance seat 3c which made the trapezoidal shape mostly the flat-surface configuration for carrying a light emitting device 4 is formed in each of subreflector 3a and main reflector 3b of the position which counters this, and cavity 3d for being able to dent downward under this maintenance seat 3c, and giving a crevice between the bases of a light emitting device 4 is prepared in it. Among maintenance seat 3c, as shown in drawing 1 , reflective block 3e made into the longitudinal-section configuration of a 2 equilateral trapezoidal shape is formed, and a this cavity 3d bottom makes the 2nd page of this block 3e the light-receiving reflectors 3f and 3g of the light which goes downward from a light emitting device 4 while it is in agreement with the base of the earthenware mortar-like mounting 3. As long as an outline is the thing of a truncated cone or a truncated pyramid, any are [ that what is necessary is just what can form the reflector of a trapezoidal shape like illustration ] sufficient as block 3e. In addition, a light emitting device 4 is pasted up on this maintenance seat 3c with the transparent paste 6 while it carries a both-sides portion on maintenance seat 3c, as shown in drawing 1 .

[0023] In the above composition, when energized to a light emitting device 4, the light from the luminous layer of a p-n junction region leaks and comes from crystal substrate 4a using transparent

sapphire also to down and the side at the same time it is emitted from the main light drawing side of the upper surface of p type layer, as stated also in advance.

[0024] since the main light drawing side is deep enough in mounting 3 and the light emitting device 4 has entered at this time -- a spread part of the light on the optical axis from an optical drawing side -- subreflector 3a and the 2nd -- secondary -- it is reflected by reflector 3a-1 and main reflector 3b towards the luminescence direction

[0025] moreover, the paste 6 with a transparent light emitted to the side from a light emitting device 4 -- escaping -- subreflector 3a of mounting 3, and the 2nd -- secondary -- the direction of reflector 3a-1 and main reflector 3b -- progressing -- such subreflector 3a and the 2nd -- secondary -- it is mostly reflected in the same direction from reflector 3a-1 and main reflector 3b with the luminescence direction from the main light drawing side of a light emitting device 4

[0026] Furthermore, the light which goes downward from crystal substrate 4a changes an optical path in the 2nd a-subreflector 31 direction of the couple which has countered these, after being reached and reflected in the light-receiving reflectors 3f and 3g of reflective block 3e located just under a light emitting device 4. and the light from the side -- the same -- this 2nd [ the ] -- secondary -- it is reflected by reflector 3a-1 and progresses in the almost same direction as the luminescence direction from the optical drawing side of a light emitting device 4

[0027] thus, the light from the optical drawing side of a light emitting device 4 -- including -- crystal substrate 4a to the side and the light which leaks caudad -- subreflector 3a of mounting 3, and the 2nd -- secondary -- it is altogether reflected from reflector 3a-1 and main reflector 3b therefore -- for example, in the case where light is made to emit from the main light drawing side after reflecting the light which leaked and came out of crystal substrate 4a and carrying out incidence to this crystal substrate 4a, the quantity of light which finally emits light by relations, such as permeability of light, declines -- receiving -- subreflector 3a and the 2nd -- secondary -- the direct reflected light from reflector 3a-1 and main reflector 3b is obtained In addition to luminescence from an optical drawing side, the light emitted from transparent crystal substrate 4a can be added by this, and luminous efficiency can be raised sharply.

[0028] Although drawing 4 is the cross section of an important section showing the posture of the luminescence equipment when including in the luminescence display panel arranged along with sheathing, such as a building, in a high position and is considering as two arrays up and down in the example of illustration, it is undoubted in an actual luminescence display panel that much luminescence equipments are uniformly arranged in the same flat surface.

[0029] The leadframe 1 which has connected luminescence equipment to the printed circuit board (not shown) of a luminescence display panel is arranged as a posture in which subreflector 3a of mounting 3 becomes the bottom, and when a luminescence display panel is seen from the luminescence side side, it appears like drawing 2 , so that drawing 4 may show.

[0030] In the array of such luminescence equipment, main reflector 3b comes to cover the light-emitting-device 4 bottom. For this reason, although the main light drawing side of light-emitting-device 4 self has been horizontally suitable in drawing, since the main light drawing side has entered deeply in mounting 3, a part of luminescence from this main light drawing side is reflected by main reflector 3b. moreover -- the light which leaks the side of crystal substrate 4a, and back -- subreflector 3a and the 2nd -- secondary -- reflector 3a-1 interferes

[0031] At this time, the light reflected in main reflector 3b serves as an optical path crossed under slant from the main optical axis of the optical path from the main light drawing side of a light emitting device 4. and -- since subreflector 3a is opened towards the bottom so that the reflected light from this main reflector 3b may not be interrupted -- the reflected light from main reflector 3b -- the --



all are released towards [ almost ] the bottom of slant Therefore, the directive thing which turns to the bottom of slant increases as the alternate long and short dash line shows the quantity of light distribution of the reflected light by the side of the front face of mounting 3 about the thing of lower-berth arrangement in drawing 4 .

[0032] Here, if the reflected light from main reflector 3b is added to the amount of luminescence from the main light drawing side of a light emitting device 4, compared with structure, improvement in about 10% of luminescence brightness is conventionally possible on the whole. Therefore, even if it is arrangement of drawing 4 which the light from the main light drawing side of a light emitting device 4 turns to horizontally, by the reflected light from main reflector 3b being added, luminescence brightness when the observer by the side of the ground sees becomes high, and can be regarded as a clear picture.

[0033]

[Effect of the Invention] In invention of a claim 1, since directivity is given by the mounting itself with which a leadframe, a printed circuit board, etc. are equipped about each of the light emitted from the light and the transparent crystal substrate from the main light drawing side of a light emitting device, if precision of the nest posture of the leadframe to a luminescence display panel is made high, a gap or dispersion of the luminescence direction after an assembly will not be produced, and a good luminescence picture will be acquired by it.

[0034] In invention of a claim 2, since the reflected light from the main reflector can be added as a luminous-intensity-distribution component of the inclination place, it becomes possible to reproduce the high luminescence picture of precision with the easy composition which gives these main reflectors and a subreflector to mounting prepared in a leadframe, a printed circuit board, etc.

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## DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] Drawing of longitudinal section showing the important section of the luminescence equipment using the gallium-nitride system compound semiconductor light emitting device by the gestalt of 1 operation of this invention

[Drawing 2] The plan of drawing 1

[Drawing 3] Drawing of longitudinal section by the A-A line view of drawing 1

[Drawing 4] The schematic diagram showing the inclination of slanting facing down of the reflected light by the array posture and the main reflector of a leadframe to a luminescence display panel

[Drawing 5] The schematic diagram showing an example of the conventional Light Emitting Diode

lamp

[Drawing 6] It is the schematic diagram showing that to which it is the conventional example which makes a Light Emitting Diode lamp the posture of slanting facing down, and drawing (b) showing that to which (a) bends a leadframe bends a printed circuit board.

[Description of Notations]

1 Leadframe (Loading Flow Member)

2 Leadframe

3 Mounting

3a A subreflector

3a-1 The 2nd subreflector

3b The main reflector

3c Maintenance seat

3d Cavity

3e Reflective block

3f, 3g Light-receiving reflector

4 Light Emitting Device

4a Crystal substrate

4b p lateral electrode

4c n lateral electrode

5a, 5b Wire

6 Paste

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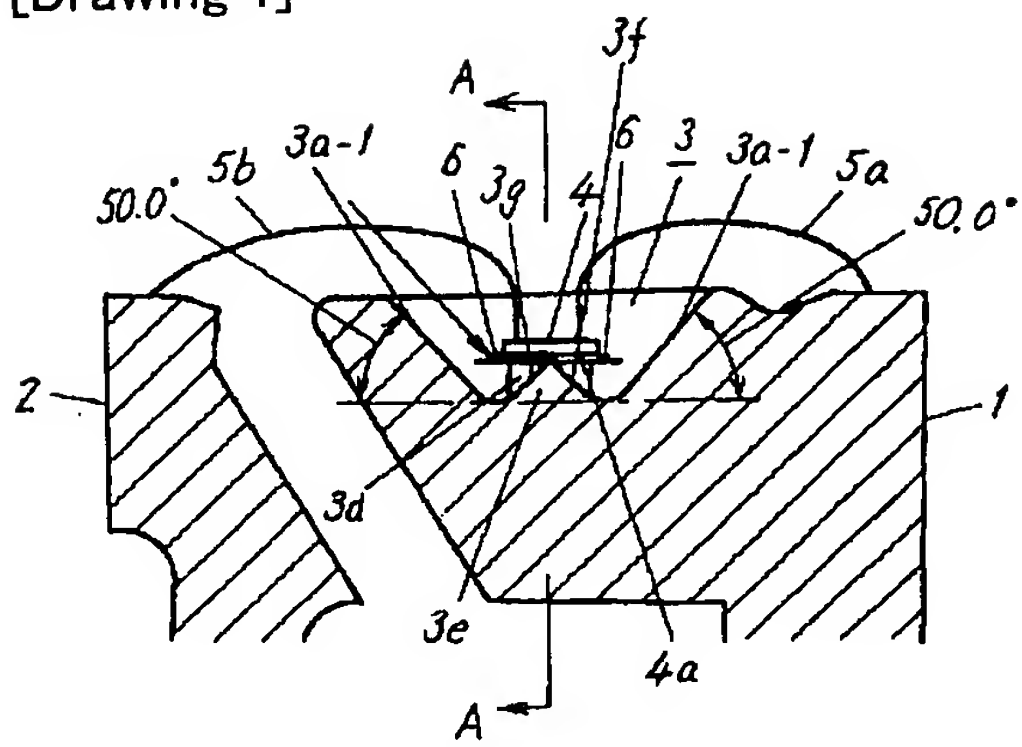
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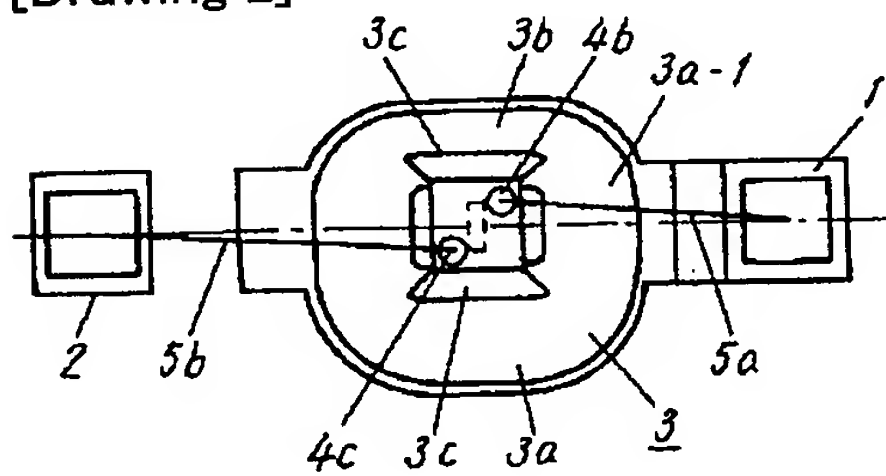
DRAWINGS

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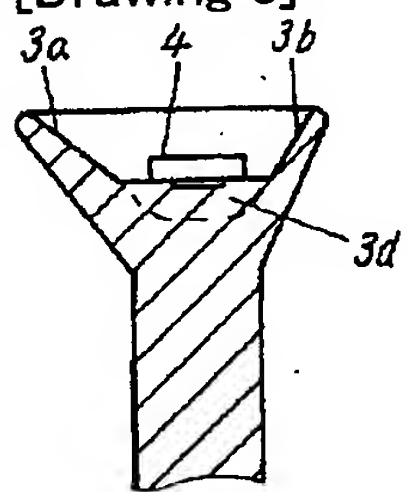
[Drawing 1]



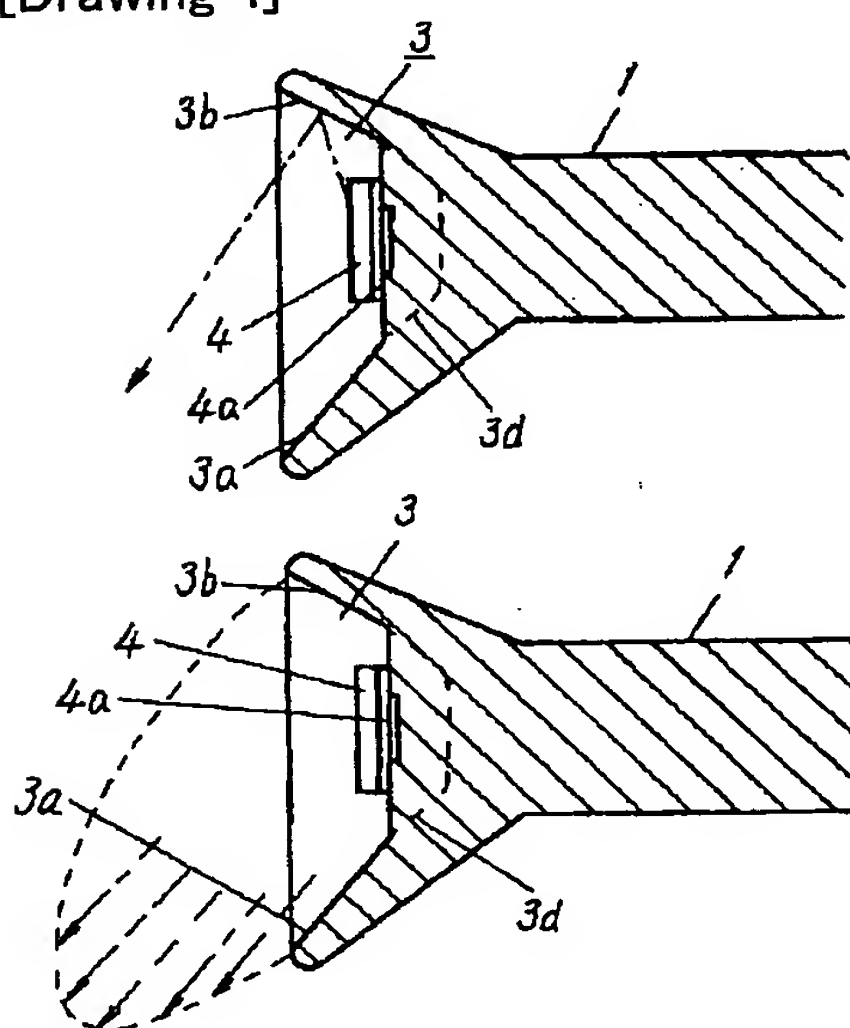
[Drawing 2]



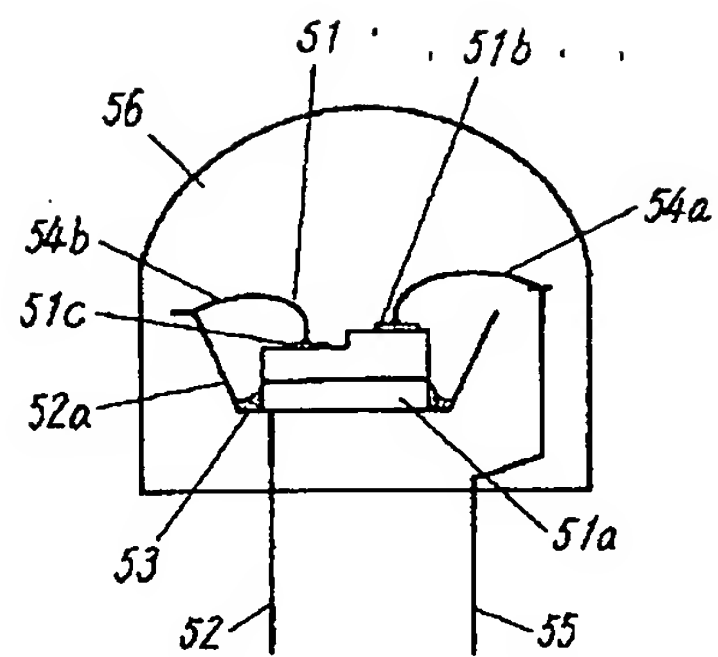
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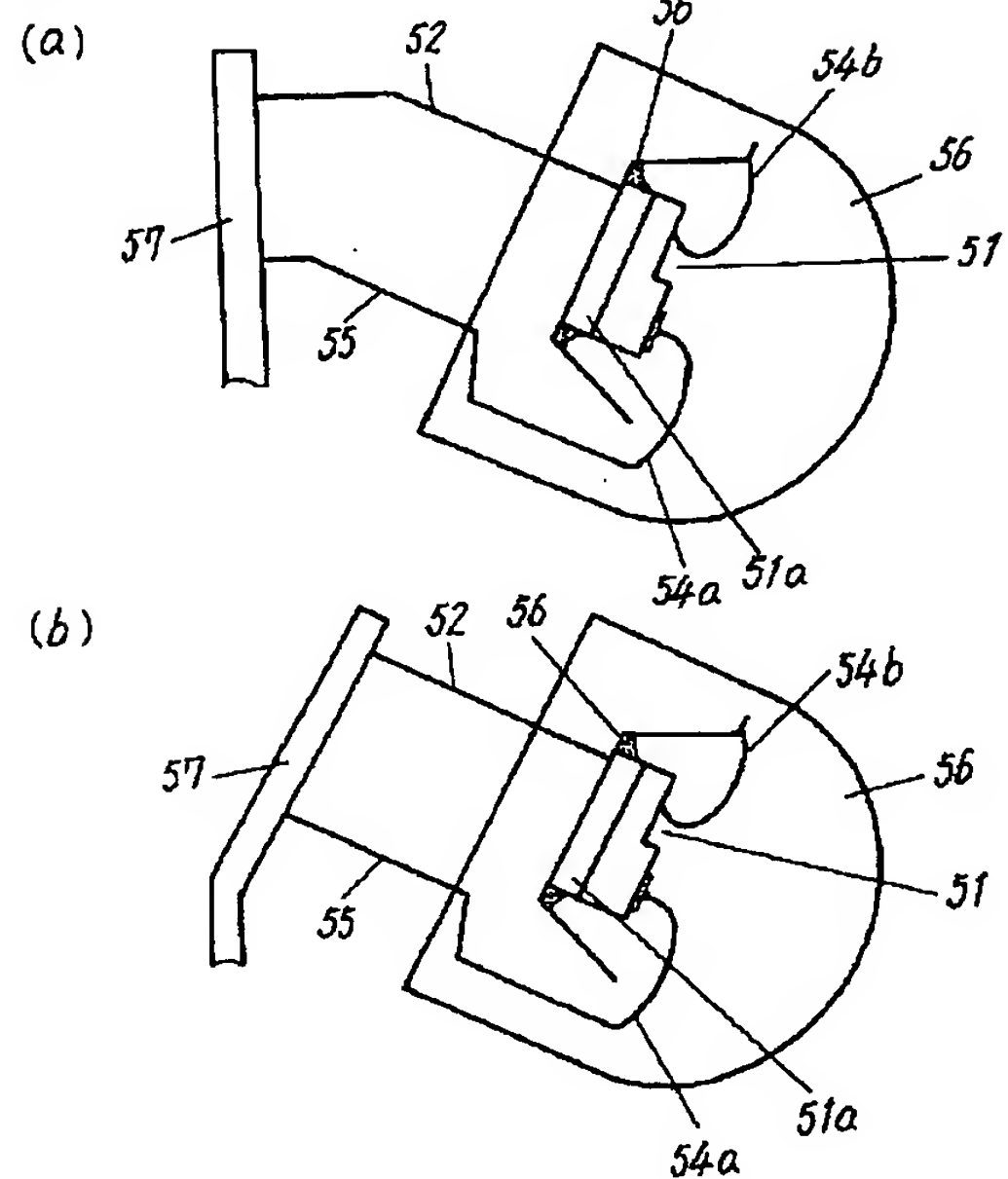
[Drawing 4]



[Drawing 5]



[Drawing 6]



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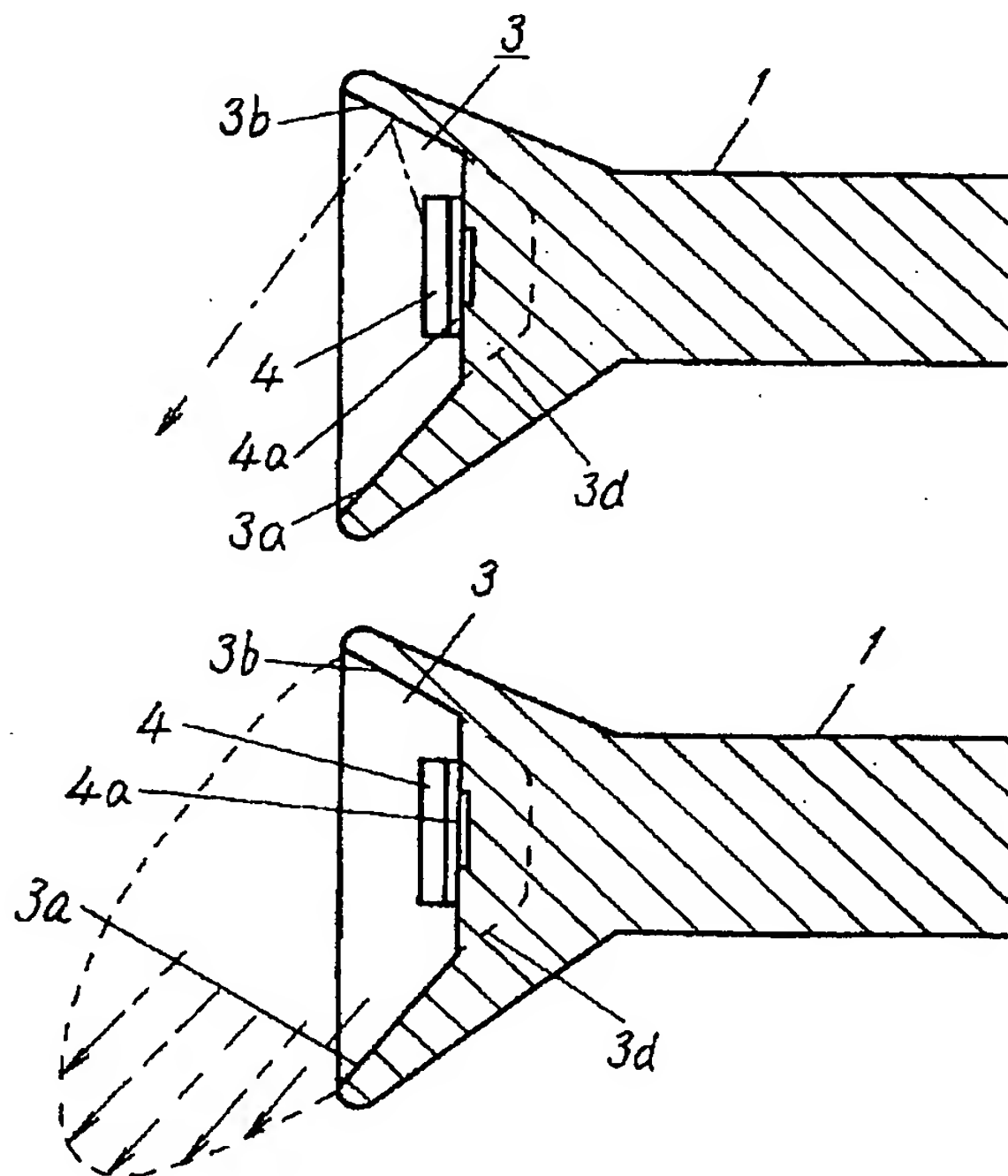
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(54) 【発明の名称】 半導体発光装置

(57) 【要約】

【課題】 発光素子からの配光性を常に一定に設定できるようにして製作誤差の影響を受けずに良好な発光表示パネルが得られる発光装置を提供する。

【解決手段】 結晶基板4aの上にp-n接合の半導体層を積層した発光素子4と、この発光素子4を搭載するマウント3を一体に備えて発光素子に電氣的に導通させるリードフレーム1とを備え、マウント3は、発光素子4をその光取出し面のうち発光輝度が最も高い主光取出し面が埋没する程度の深さの凹状体とするとともに、発光素子4の少なくとも一面からの光に対して指向性を与える反射光を付与可能な反射面構造を備え、主光取出し面からの光や透明の結晶基板4aの場合であればその側方及び背部側への光も含めてマウント3の反射面から指向性を持たせた光の配光を可能とする。



## 【特許請求の範囲】

【請求項1】 結晶基板の上にp-n接合の半導体層を積層した発光素子と、この発光素子を搭載して電氣的に導通させる搭載導通部材とを備え、搭載導通部材には、発光素子の光取出し面が埋没する程度の深さの凹状体とするとともにその内面を光反射面としたマウントを形成した半導体発光装置であって、マウントには、発光素子の最も発光輝度が高い主光取出し面からの主光軸を含む平面に対して、発光素子の主光軸方向以外の放出光を一定の範囲の入射交差角度をもつ方向に反射させる反射面構造を備えてなる半導体発光装置。

【請求項2】 マウントの反射面構造は、発光素子を間に挟んで対向する二つの領域に区分けした主反射面と副反射面とを含み、主反射面及び副反射面とそれぞれの発光素子の主光軸との交差角度を相対的に小及び大の関係とし、主光取出し面からの拡散光及びこの主光取出し面以外からの放出光の反射光の光量分布が、主反射面側よりも副反射面側が大きくなるように偏らせてなる請求項1記載の半導体発光装置。

## 【発明の詳細な説明】

## 【0001】

【発明の属する技術分野】本発明は、LED発光素子をリードフレームやプリント基板またはその他の成型品に形成したマウントに搭載する発光装置に係り、特にマウントに形成する反射面の角度を適正にすることによって発光装置からの配光性を向上させてその発光表示を最適化できるようにした発光装置に関する。

## 【0002】

【従来の技術】従来から、結晶基板に半導体薄膜層を積層してp-n接合した半導体積層膜を形成してp側及びn側の電極を備えたLED発光素子が発光表示パネル用として多用されている。このLED発光素子は、たとえば電氣的に導通させるための部材として備えるリードフレームに予め形成されたマウントの上に搭載され、ワイヤボンディングによってリードフレームに接続するというものがその基本的な構成である。

【0003】図5はこのようなリードフレームのマウントに対する発光素子の搭載構造の従来例を示す概略図である。

【0004】図示の例は、窒化ガリウム系化合物の半導体膜を積層した青色LEDとして使用できるものであり、発光素子51はその絶縁性の基板51aをリードフレーム52の上端に形成したマウント52aの上に搭載してペースト53によって接着され、発光素子51の上端にそれぞれ形成したp側極51b及びn側極51cをワイヤ54a、54bによってリードフレーム52及びこれと対をなしている他方のリードフレーム55に接続している。そして、発光素子51を含めてマウント52a周りの全体がエポキシ樹脂56によって封止されている。

【0005】このような発光素子51を含むLEDランプでは、発光素子51の窒化ガリウム系化合物の半導体膜のp-n接合域を発光層として、p側極51bを含む領域を占めるp型層の上面を光取出し面として上向きの発光が得られる。また、基板51aを透明のサファイアとしたものでは、発光層からマウント52aに向かう光がこのマウント52aから反射され、この反射分も含めて光取出し面からの発光に合流する。

【0006】一方、発光素子51を備えた3原色のLEDランプを多数集合させて配置した発光表示パネルは、各LEDランプがそれぞれ画素となって各種の画像の表示及びカラー表示が可能である。そして、この発光表示パネルは比較的小型のものから屋外用の大型画面用のものがあり、その設置場所もさまざまである。

【0007】たとえば、発光表示パネルをビルの外装壁に沿う高い位置に設けた場合では、表示による情報の提供は歩道上の歩行者や走行中の自動車などの運転者が対象となることが普通である。したがって、歩行者や運転者は、表示パネルを観るときには見上げる姿勢となることが多く、図5に示したLED発光装置の場合でも図においてこれを時計方向に90°回転させてその光軸を水平方向として表示パネルに配列すると、観察者に対しては光路が大きすぎてしまう関係となる。

【0008】そこで、図6に示すように、発光素子51及び光反射のためのマウント52aによる光路の設定を斜め下向きとすれば、発光表示パネルを見上げる人に対して光の配光性を持たせることができる。これにより、表示を観る人にとっては表示が明るくてより鮮やかなものとなる。

## 【0009】

【発明が解決しようとする課題】発光素子51からの光の光軸を下向きとするには、たとえば図6の(a)に示すように、発光表示パネルの全面に備えるプリント基板57に接続したリードフレーム52、55を下向きに曲げることで対応できる。また、リードフレーム52、55の曲げ変形による姿勢の誤差を抑えるため、同図の(b)に示すようにプリント基板57の一部を舌片状に斜めに倒して発光素子51の向きを地上側に合わせることもできる。

【0010】ところが、リードフレーム52、55やプリント基板57を曲げ加工する場合では、それぞれの曲げ角度は製作誤差を伴うので、ばらつきを生じることが避けられず、製作過程での管理も厳しくしなければならない。そして、曲げ角度の精度が不良となると、各画素に対応する発光素子51の配光方向にもばらつきを招くことになり、発光表示パネルからの画像表示の鮮明さにも大きく影響を及ぼす。

【0011】このように、発光素子51を観察者側を指向するように適正な姿勢で発光表示パネルに組み込むことができれば、発光表示の形態を良好に維持できるもの

の、従来構造では製作誤差が無視できず、品質管理の面でも煩雑になりやすい。

【0012】本発明において解決すべき課題は、発光素子からの配光性を常に一定に設定できるようにして製作誤差の影響を受けずに良好な発光表示パネルが得られる発光装置を提供することにある。

【0013】

【課題を解決するための手段】本発明は、結晶基板の上にp-n接合の半導体層を積層した発光素子と、この発光素子を搭載して電氣的に導通させる搭載導通部材とを備え、搭載導通部材には、発光素子の光取出し面が埋没する程度の深さの凹状体とするとともにその内面を光反射面としたマウントを形成した半導体発光装置であって、マウントには、発光素子の最も発光輝度が高い主光取出し面からの主光軸を含む平面に対して、発光素子の主光軸方向以外の放出光を一定の範囲の入射交差角度をもつ方向に反射させる反射面構造を備えてなることを特徴とする。

【0014】このような構成であれば、たとえば搭載導通部材としてリードフレームを用いる場合では、このリードフレームの先端にマウントを形成してこれに発光素子を搭載したとき、発光素子の光取出し面の中で最も発光輝度が高い主光取出し面からの光はもちろんのこと、その他の光取出し面からの光も指向性を与えて発光させることができる。この場合、主光取出し面が発光方向に一致した透明結晶基板の発光素子であって結晶基板をマウントの搭載面に対峙した姿勢としたものでは、この透明の結晶基板から漏れる光をマウントからの反射光として回収することができる。

【0015】なお、本発明においては、発光素子を搭載して電氣的に導通させる搭載導通部材は、発明の実施の形態の項で示すようにリードフレームであり、この他にもプリント基板またプリント基板の上方に別体として配置する各種の成型品とすることができる。

【0016】

【発明の実施の形態】請求項1に記載の発明は、結晶基板の上にp-n接合の半導体層を積層した発光素子と、この発光素子を搭載して電氣的に導通させる搭載導通部材とを備え、搭載導通部材には、発光素子の光取出し面が埋没する程度の深さの凹状体とするとともにその内面を光反射面としたマウントを形成した半導体発光装置であって、マウントには、発光素子の最も発光輝度が高い主光取出し面からの主光軸を含む平面に対して、発光素子の主光軸方向以外の放出光を一定の範囲の入射交差角度をもつ方向に反射させる反射面構造を備えてなるものであり、マウント自体によって、発光素子の主光取出し面からの光及び透明結晶基板を備えるものであればその側面と裏面から放出される光を効率的に取り出すという作用を有する。

【0017】請求項2に記載の発明は、マウントの反射

面構造は、発光素子を間に挟んで対向する二つの領域に区分けした主反射面と副反射面とを含み、主反射面及び副反射面とそれぞれの発光素子の主光軸との交差角度を相対的に小及び大の関係とし、主光取出し面からの拡散光及びこの主光取出し面以外からの放出光の反射光の光量分布が、主反射面側よりも副反射面側が大きくなるように偏らせてなるものであり、主反射面からの反射光をその指向先の配光成分として加えることができるという作用を有する。

【0018】以下に、本発明の実施の形態の具体例を図面を参照しながら説明する。図1は本発明の一実施の形態における窒化ガリウム系化合物の半導体膜によって形成されるLEDチップを発光素子として備えるLEDランプの要部の縦断面図、図2は図1の平面図、及び図3は図1のA-A線矢視による縦断面図である。

【0019】図において、その上端部がエポキシ樹脂によって封止される一対のリードフレーム1、2を備え、一方のリードフレーム1を本実施の形態における搭載導通部材としている。一方のリードフレーム1の上端には発光素子4を搭載するためのマウント3をほぼすり鉢状に凹ませて形成するとともにその内周面の全体を鏡面状としている。発光素子4は、下端側に透明のサファイアを用いた結晶基板4aを設けるとともに上端側にp側電極4b及びn側電極4cを形成し、これらのそれぞれをワイヤ5a、5bによってリードフレーム1、2にワイヤボンディングしている。

【0020】発光素子4は、その上面であってp側電極4bを含むp型層を発光輝度が最も高い主光取出し面とし、この主光取出し面からの発光光路中に主光軸を含むものであり、発光層の下側に位置している結晶基板4aからもその側方及び下方に向けて発光する。

【0021】マウント3は、図2に示すように、平面形状がほぼ正方形の発光素子4に対してこれを偏心させて配置するようなすり鉢状に形成され、発光素子4の偏心方向と逆側の向きを40°程度の勾配の副反射面3aとし、これと対向する領域を60°程度の勾配の主反射面3bとしている。そして、これらの副反射面3a及び主反射面3bの間には、図1に示すようにその勾配を50°程度とした光路の幅方向の指向性を付与する第2の副反射面3a-1としている。

【0022】副反射面3aとこれに対向する位置の主反射面3bのそれぞれには、発光素子4を載せるための平面形状をほぼ台形状とした保持座3cを形成し、この保持座3cの下方には下に凹ませて発光素子4の底面との間に隙間を持たせるためのキャビティ3dを設ける。このキャビティ3dの底はすり鉢状のマウント3の底面に一致するとともに、保持座3cどうしの間には、図1に示すように2等辺の台形状の縦断面形状とした反射ブロック3eが形成され、このブロック3eの2面を発光素子4から下に向かう光の受光反射面3f、3gとしてい



る。ブロック3eは図示のような台形状の反射面を形成できるものであればよく、外郭が円錐台や角錐台のものであればいずれでもよい。なお、発光素子4は図1に示すように、保持座3cの上に両辺部分を載せるとともに透明のペースト6によってこの保持座3cに接着されている。

【0023】以上の構成において、発光素子4へ通電されるときにはp-n接合域の発光層からの光は、先にも述べたようにp型層の上面の主光取出し面から放出されると同時に透明のサファイアを利用した結晶基板4aから下方向及び側方へも漏れ出る。

【0024】このとき、発光素子4はその主光取出し面がマウント3の中に十分に深く入り込んでいるので、光取出し面からの光軸上の光の拡散分は副反射面3aと第2の副反射面3a-1及び主反射面3bとによって発光方向に向けて反射される。

【0025】また、発光素子4から側方に放出される光は、透明のペースト6を抜けてマウント3の副反射面3aと第2の副反射面3a-1及び主反射面3b方向に進み、これらの副反射面3a、第2の副反射面3a-1、主反射面3bから発光素子4の主光取出し面からの発光方向とほぼ同じ向きに反射される。

【0026】更に、結晶基板4aから下に向かう光は、発光素子4の真下に位置している反射ブロック3eの受光反射面3f、3gに達して反射された後、これらに対向している一対の第2の副反射面3a-1方向に光路を変える。そして、側方からの光と同様に、この第2の副反射面3a-1で反射されて発光素子4の光取出し面からの発光方向とほぼ同じ方向に進む。

【0027】このように、発光素子4の光取出し面からの光も含めて、結晶基板4aから側方及び下方に漏れる光は、マウント3の副反射面3a、第2の副反射面3a-1及び主反射面3bから全て反射される。したがって、たとえば結晶基板4aから漏れ出た光を反射させた後にこの結晶基板4aに入射させた後に主光取出し面から発光させる場合では、光の透過率等の関係によって最終的に発光される光量が減衰してしまうのに対し、副反射面3a、第2の副反射面3a-1及び主反射面3bからの直接的な反射光が得られる。これにより、光取出し面からの発光に加えて、透明の結晶基板4aから放たれる光を加えることができ、発光効率を大幅に向上させることができる。

【0028】図4はビル等の外装に沿って高い位置に配置される発光表示パネルに組み込んだときの発光装置の姿勢を示す要部の断面図であり、図示の例では上下に2個の配列としているが、実際の発光表示パネルでは同一平面内に多数の発光装置が一様に配列されることは無論である。

【0029】図4から判るように、発光装置を発光表示パネルのプリント基板（図示せず）に接続しているリー

ドフレーム1は、マウント3の副反射面3aが下側となる姿勢として配置され、発光表示パネルをその発光面側から見たときには図2のように現れる。

【0030】このような発光装置の配列では、発光素子4の上側に主反射面3bが被さるようになる。このため、発光素子4自身の主光取出し面は図において水平方向を向いたままであるが、主光取出し面はマウント3内に深く入り込んでいるので、この主光取出し面からの発光の一部は主反射面3bによって反射される。また、結晶基板4aの側方及び背部に漏れる光については、副反射面3aと第2の副反射面3a-1が干渉する。

【0031】このとき、主反射面3bに当たって反射する光は、発光素子4の主光取出し面からの光路の主光軸から斜め下に横切る光路となる。そして、副反射面3aはこの主反射面3bからの反射光を遮らないように下側に向けて開いているので、主反射面3bからの反射光はその殆ど全てが斜め下に向けて放たれる。したがって、マウント3の前面側での反射光の光量分布は、図4において下段配置のものについて一点鎖線で示しているように、斜め下を向く指向性のものが多くなる。

【0032】ここで、発光素子4の主光取出し面からの発光量に対して、主反射面3bからの反射光が加わると、従来構造に比べると全体で10%程度の発光輝度の向上が可能である。したがって、発光素子4の主光取出し面からの光が水平方向を向くような図4の配置であっても、主反射面3bからの反射光が加わることで、地上側の観察者が観たときの発光輝度は高くなり、鮮明な画像として捉えることができる。

【0033】

【発明の効果】請求項1の発明では、リードフレームやプリント基板等に備えるマウント自体によって、発光素子の主光取出し面からの光及び透明結晶基板から放出される光のそれぞれについて指向性が与えられるので、発光表示パネルへのリードフレームの組込み姿勢の精度を高くしておけば、組み立て後の発光方向のずれやばらつきを生じることがなく、良好な発光画像が得られる。

【0034】請求項2の発明では、主反射面からの反射光をその指向先の配光成分として加えることができるので、リードフレームやプリント基板等に設けるマウントにこれらの主反射面及び副反射面を持たせるだけの簡単な構成で精度の高い発光画像を再生することが可能となる。

【図面の簡単な説明】

【図1】本発明の一実施の形態による窒化ガリウム系化合物半導体発光素子を用いた発光装置の要部を示す縦断面図

【図2】図1の平面図

【図3】図1のA-A線矢視による縦断面図

【図4】発光表示パネルへのリードフレームの配列姿勢及び主反射面による反射光の斜め下向きの指向を示す概



略図

【図5】従来のLEDランプの一例を示す概略図

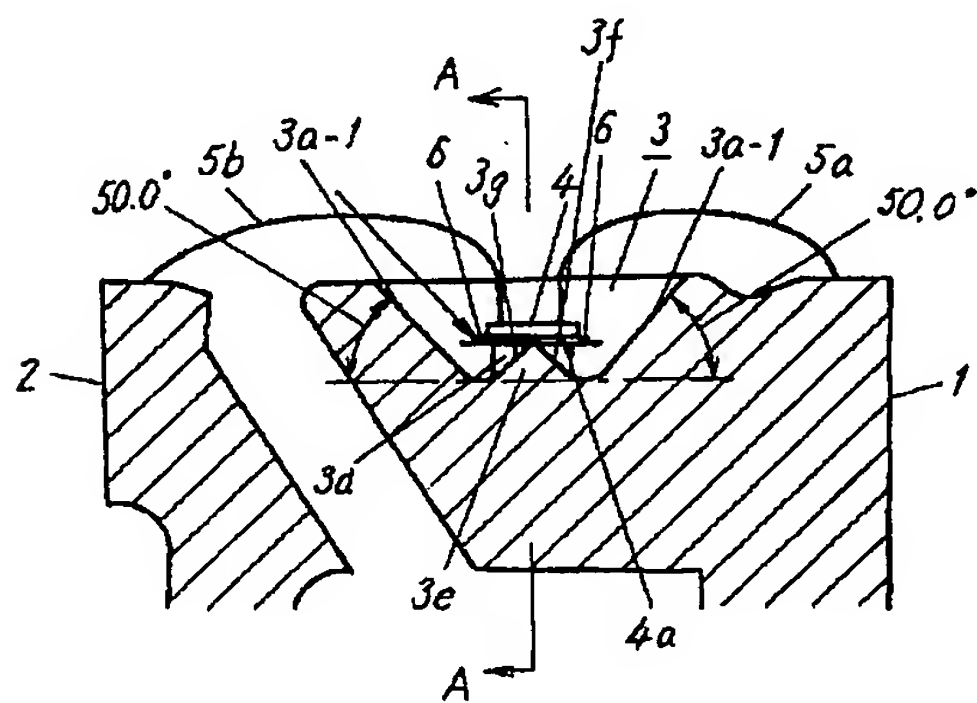
【図6】LEDランプを斜め下向きの姿勢とする従来例であって、(a)はリードフレームを曲げるもの、(b)はプリント基板を曲げるもの、を示す概略図

【符号の説明】

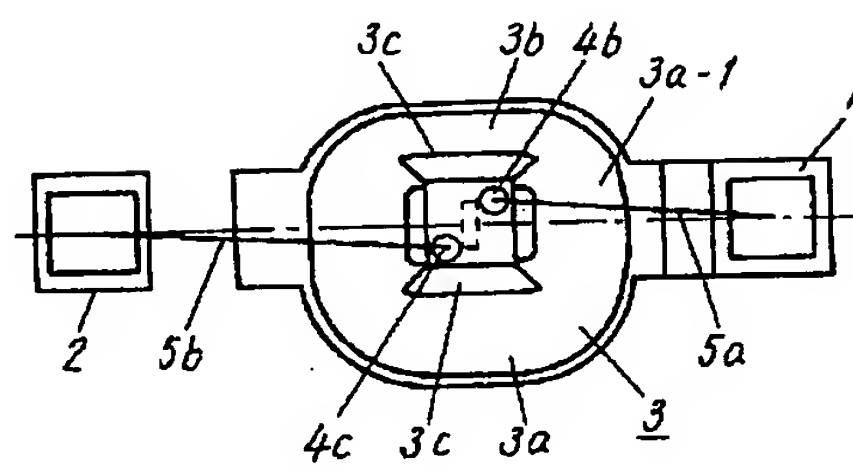
- 1 リードフレーム（搭載導通部材）  
 2 リードフレーム  
 3 マウント  
 3a 副反射面  
 3a-1 第2の副反射面

- 3b 主反射面  
 3c 保持座  
 3d キャビティ  
 3e 反射ブロック  
 3f, 3g 受光反射面  
 4 発光素子  
 4a 結晶基板  
 4b p側電極  
 4c n側電極  
 5a, 5b ワイヤ  
 6 ペースト

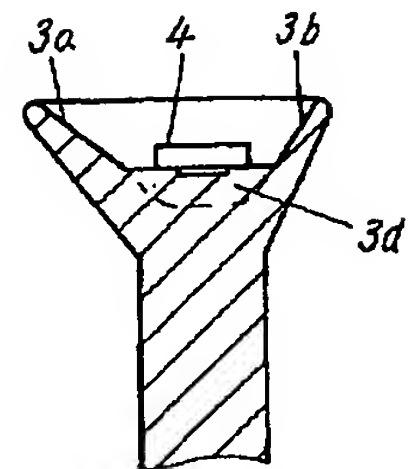
【図1】



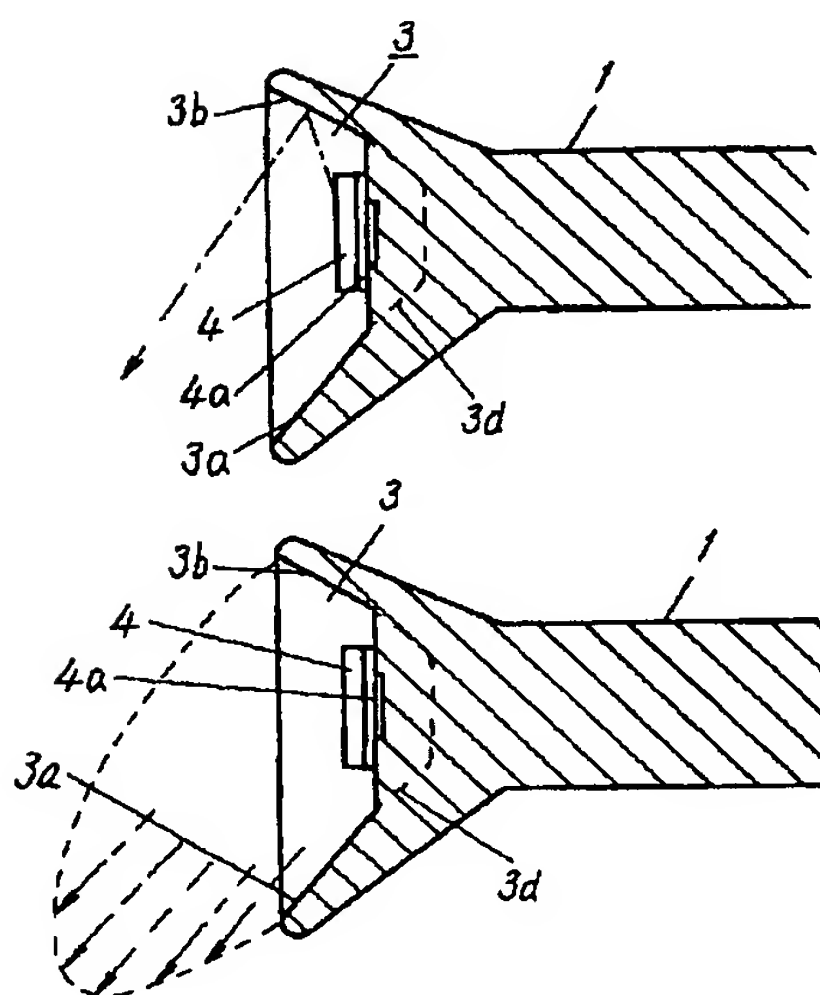
【図2】



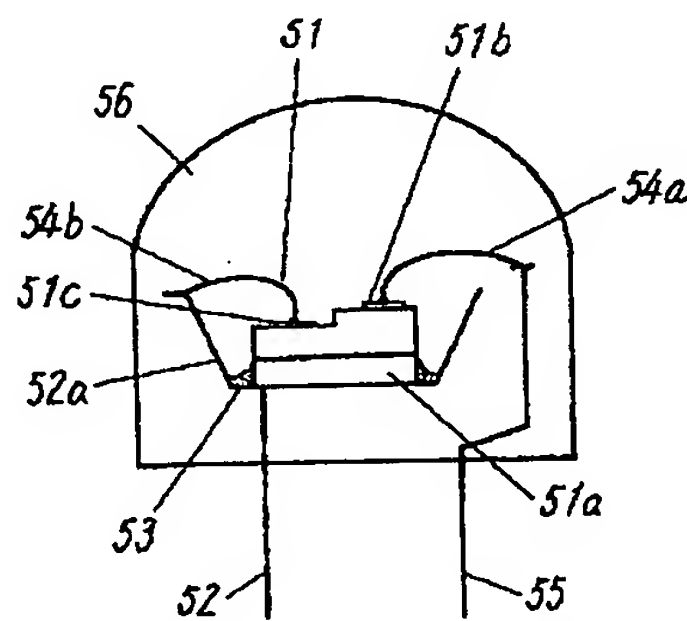
【図3】



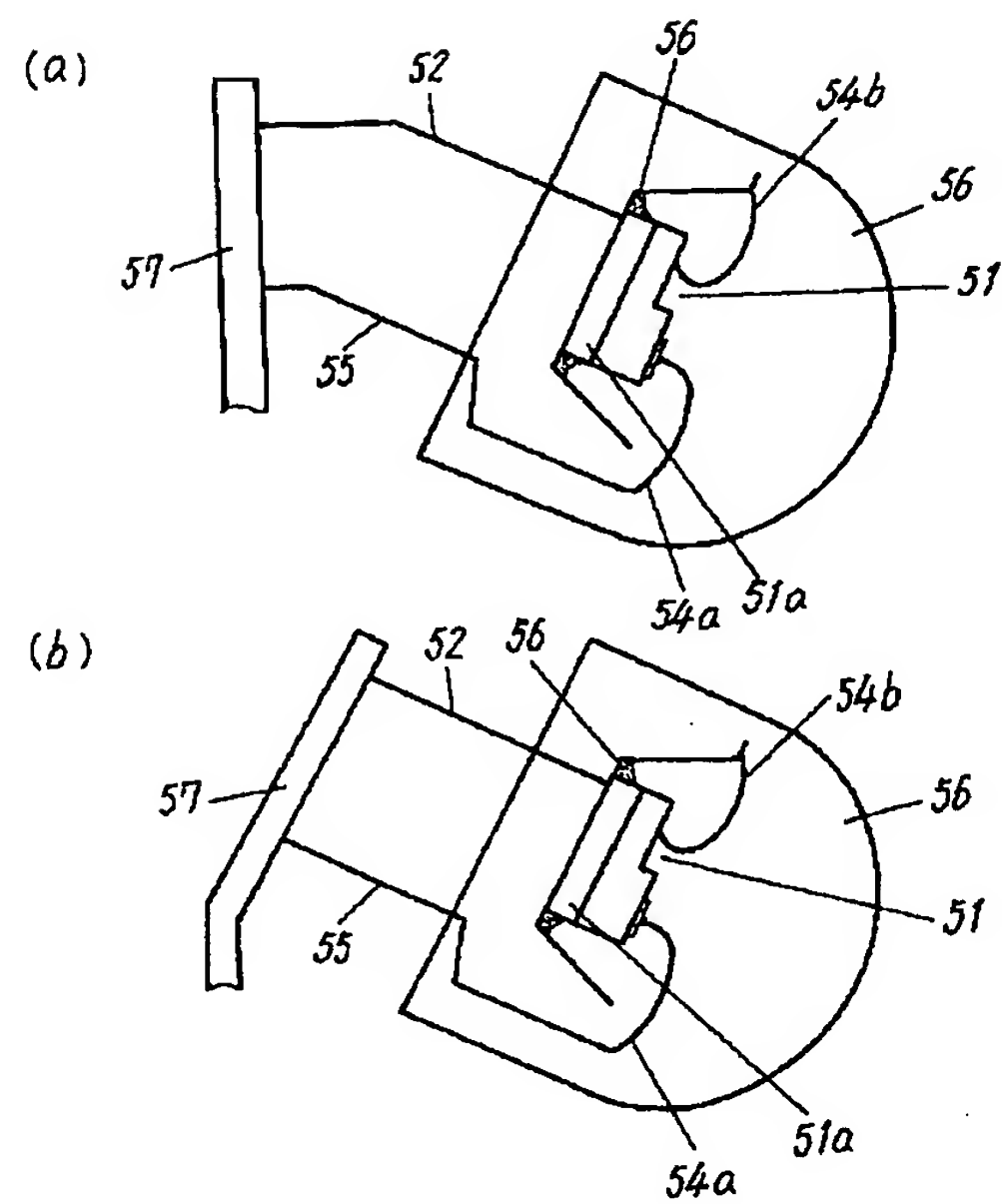
【図4】



【図5】



【図6】



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フロントページの続き

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